COORDINATING COMMISSION
FOR POSTSECONDARY EDUCATION

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PROPOSAL FOR NEW INSTRUCTIONAL PROGRAM

Form 92-40

SECTION I

Institution Submitting Proposal: University of Nebraska at Omaha

Title of Program: Master of Science in Computer Science Education

CIP Code: 11.0101

Organizational Unit in which program will be located:

Department of Computer Science
College of Information Science and Technology

Name of contact person in the event additional information is needed: Dr. Susan M. Fritz

Telephone: 402-472-5242

Degree, Diploma, or Certificate to be offered (use separate submittal for each level):

Master of Science in Computer Science Education

Proposed date to initiate program: When approved by the Coordinating Commission

List the location(s) where this program will be offered: UNO

If the program has a projected ending date, please so indicate:

Date approved by Governing Board: September 16, 2016
(Attach all documents related to this proposal upon which the Governing Board made its decision to approve the proposal.)

Chief Executive Officer's or other Authorized Officer's signature: Susan M. Fritz

Susan M. Fritz

University of Nebraska Omaha

M.S. in Computer Science Education Proposal

Descriptive Information:

- Name of institution proposing the program: The University of Nebraska at Omaha (UNO)
- Name of the program (major) proposed: Computer Science Education
- Degrees/credentials to be awarded graduates of the program: Master of Science (M.S.)
- Other programs offered in this field by this institution: M.S. in Computer Science; M.S. in Elementary Education, M.S. in Secondary Education
- CIP code: 11.0101
- List the administrative units for the program: Graduate College, College of Information Science & Technology, Department of Computer Science
- Proposed delivery sites, and types of delivery, if applicable: On campus and distance education
- Date approved by governing board:
- Proposed date (term/year) the program will be initiated: Upon approval

1. Description and Purpose of the Proposed Program:

The Department of Computer Science (CS) and the Department of Teacher Education (TED) at the University of Nebraska at Omaha (UNO) propose to collaboratively develop and implement a new joint Master of Science degree program in Computer Science Education (MS-CSE). The proposed MS-CSE degree program, to be hosted by the College of Information Science & Technology (CIST) with ongoing collaboration from the College of Education (CoE), is designed for students who are interested in teaching computer science at the K-12 level.

The primary target groups are in-service middle- and high-school STEM teachers in Nebraska, the eight-state Midwest region surrounding Nebraska, and nationwide – where there is a critical demand for the proposed program. The proposed program will not exclude pre-service teachers. A secondary target group comprises students in other graduate degree programs who may elect to take one or two courses in the MS-CSE program. The proposed program will boost Nebraska to a higher rank of states that aggressively support computer science education, while positioning UNO to become a national leader in this important educational focus.

Interactions with K-12 teachers and community partners indicate that outreach efforts are currently underway in Nebraska to raise awareness and increase access to high-quality K-12 instruction in computing. This has brought together key personnel from UNO's College of Information Science & Technology, UNL's Department of Computer Science and Engineering, and active K-12 teachers from both the Lincoln and Omaha Computer Science Teachers Association chapters. The goal is to require formal training of CS teachers, increase access to a broad range of computing courses, and have those courses serve as more than electives for the students who take them. Thus, it is no surprise that the proposed MS-CSE degree program has garnered strong support from initial contacts of K-12 teachers who participated in the college's previous events and activities, and are interested in pursuing the MS-CSE program (see the attached support letters).

Further, the IT supplemental teaching endorsement and graduate certificate which makes up the core component of this master's program will directly benefit the teachers who pursue the MS-CSE degree in a number of ways. First, it will enable these teachers to confidently teach a wider variety of secondary-level computing courses including AP Computer Science A, the forthcoming AP CS Principles course that has been in development by National Science Foundation (NSF) and the College Board, and dual

enrollment courses in partnership with University of Nebraska campuses. Second, it will enable these teachers to systematically integrate their knowledge of computing with their primary endorsement discipline (which could range from mathematics, to science, to even language or arts); this provides an opportunity for teachers to affect changes in their local schools towards universal computational-thinking literacy, even if they are not teaching standalone computer science courses.

Establishing a rigorous MS-CSE degree program within the context of a partnership between the Department of Computer Science and the Department of Teacher Education at UNO is a small but crucial component in fulfilling UNO's campus STEM priority and making a difference for thousands of Nebraska students.

2. Program of Study:

The proposed MS-CSE degree will require a total of 30 credit hours with a capstone, thesis, or project option to meet the Assessment and Comprehensive Exam requirement for the program of study. Courses will be offered in areas such as Methods of CS Education, Foundations of CS, CS Principles, Information Assurance, Data-driven Decision Making, Software Design, Human-Computer Interaction, and STEM Innovations. Completion of 15 credit hours of the program will allow students to obtain an Information Technology (IT) Supplemental Teaching Endorsement in the State of Nebraska, and will certify teachers to teach a wide variety of secondary computing courses, including CS Advanced Placement courses. Completion of 18-24 credit hours will allow students to obtain a Graduate Certificate in Computer Science Education. Credits earned for the IT Supplemental Teaching Endorsement[1] and the Graduate Certificate[2] will apply toward completion of the MS-CSE degree program.

Students to be admitted to the MS-CSE program should first submit their application materials, which will include an application form, résumé, official transcripts, two recommendation letters, and a statement about his/her teaching philosophy. Applications will be accepted year around, with admissions take place for fall and spring semesters each year. Women, minority, and teachers with existing teaching experience in STEM areas will be encouraged to apply. Admission criteria and selection procedures for students seeking admission to the major/degree will be based on the educational background and existing teaching experiences the candidate hold when applying. Students will apply to the degree program online, and will be evaluated by the graduate program committee of the MS-CSE. Students in the MS-CSE program will be assigned a faculty mentor upon admission to the program. The mentor will work with the student and the program advisor to draft a plan of study, and oversee the fulfillment of the plan during the student's study period towards completion of the program.

Course listing for the MS-CSE program:

IT Endorsement (15 credit hours)

- TED 8006: Methods of CS Education*
- CSTE 8020: Exploring Computer Science for Teachers*, or CSTE 8030: Computer Science Principles for Teachers*
- CSTE 8040: Object Oriented Programming for Teachers**
- CSCI/IASC 8366: Foundations of Information Assurance
- CSCI 8836 Software Engineering, or CSCI 8256: Human-Computer Interaction

Core Computer Science (3 credit hours)

- CSCI 8010: Foundations of Computer Science (software)

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[1] IT Supplemental Endorsement at the grad level is in place through the College of Education and NE Department of Education as of Fall 2015.

[2] This graduate certificate will be submitted for approval once the MS-CSE degree is approved.

Core Teacher Education (3 credit hours)

- TED 8050: Data Driven Decision Making for Teachers, or TED 8030: STEM Innovation

Electives (3-6 credit hours)

- Approved electives (CSCI 8##0 or TED 8010), or independent study (CSTE 8970 or TED 8970).
  - Students will be recommended to take new graduate level courses to be developed continuously as electives along with the growth of the CSCI curriculum.
  - Students will be encouraged to take graduate level courses, such as the ISQA 8040, as electives from the College of Information Science & Technology, the College of Education, and other programs in the University of Nebraska system.

Capstone/Thesis/Project (meets Assessment and Comprehensive Exam requirement) (3-6 credit hours)

- CSTE 8910 Capstone for MS (3 credit hours), CSTE 8960 Thesis-Equivalent Project, TED 8100 Research Project (6 credit hours), CSTE 8990 Thesis, or TED 8990 Thesis (6 credit hours)

* Courses that will be developed for face-to-face instruction

** New course to be developed for the MS-CSE program merging the contents of the introductory computer programming sequence to equip teachers to teach AP Computer Science.

In addition to meeting the IT supplemental endorsement requirements, the CSTE courses will provide a solid foundation for the graduates of this MS-CSE program (the teachers) to deliver the instructions on Introduction to CS, AP CS, AP CS principles, and other relevant and similar level courses in the K-12 school curriculum. The curriculum of the CSTE program is developed based on recommendations from the Association for Computing Machinery (ACM) and the Institute for Electrical and Electronics Engineers (IEEE) Computer Society. It is the first such program in the State of Nebraska accredited by the Computing Accreditation Commission of ABET, Inc., the recognized U.S. accreditor of college and university programs in applied science, computing, engineering, and technology. The ABET accreditation entails close supervision of course contents and an alignment with current industry, business, and academia needs.

Student Learning Outcomes

The primary student learning outcomes of the proposed MS-CSE program will be the measurable abilities of qualified teachers to design, organize, instruct, and coordinate the delivery of computer science course modules, courses, and curricula to K-12 students in Nebraska schools. Teachers graduate from the program are expected to:

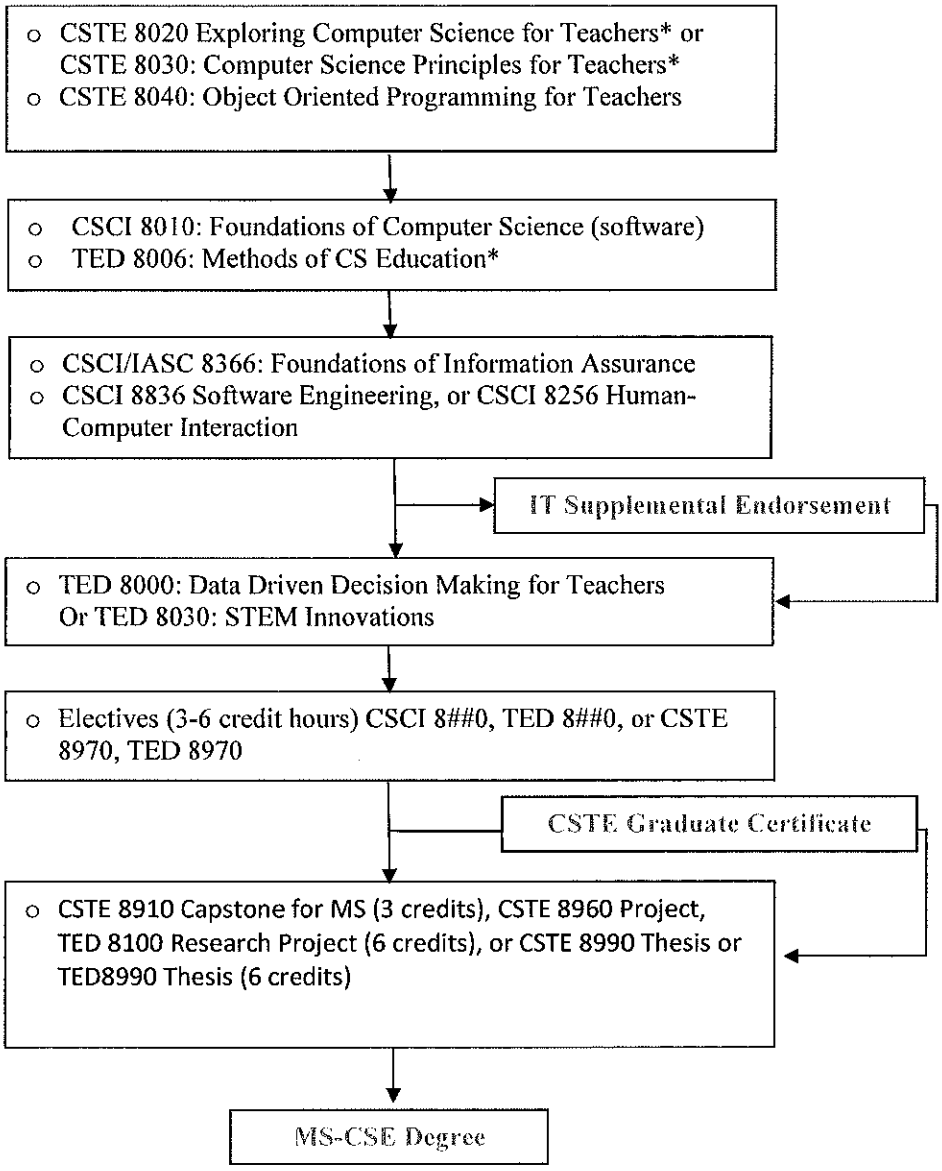
1) Gain a fundamental knowledge set about computer science models, concepts and principles,
2) Develop a skill set of computational-thinking and problem-solving techniques in major areas of computer science technology, and
3) Command a sophisticated set of methodology and pedagogical approaches for computer science instruction.

While there are no national guidelines or accreditations for such programs available, evaluation criteria for the existing Master of Science programs in Computer Science and in Teacher Education will be

adopted and revised to establish evaluation measurements for the proposed MS-CSE program.

Sample program and course sequence:

A flowchart of the course sequence and milestones for the supplemental teaching endorsement and certificate of the MS-CSE program is shown in figure 1 below. Note that if the student elects to take the CSTE 8910 capstone, the student will be required to take two electives (6 credit hours).



Schedule of course offerings and timeline for phased initial and sequential implementation:

The MS-CSE courses will be fully integrated into the regular schedule of course offerings for the College of Information Science & Technology, and the College of Education. The course preparation and offering will be coordinated in a phased order as shown below, in an expectation that the UNO campus, University system, Board of Regents, and Nebraska state-level approval of the MS-CSE program occurs before Fall 2016. Phase I courses are already under development to satisfy the newly approved graduate IT Supplemental Endorsement.

	Course	Course Title	College/ Dept.	Start Date for Development	Initial Offering
Phase I	CSTE 8020	Exploring Computer Science for Teachers *	CIST/CS	Fall 2014	Spring 2016
	CSTE 8030	Computer Science Principles for Teachers *	CIST/CS	Fall 2014	Fall 2015 (in progress)
	TED 8006	Methods of CS Education *	COE/TED	Fall 2015	Fall 2016
	CSTE 8040	Object Oriented Programming for Teachers*	CIST/CS	Spring 2015	Fall 2016
	CSCI 8010	Foundations of Computer Science (software) **	CIST/CS	Spring 2016	Spring 2017
	CSCI/IASC 8366	Foundations of Information Assurance **	CIST/IA	Spring 2016	Spring 2017
Phase II	CSCI 8836	Software Engineering (Web design component) **	CIST/CS	Summer 2016	Summer 2017
	CSCI 8256	Human-Computer Interaction (Web design component)**	CIST/CS	Summer 2016	Summer 2017
	TED 8050	Data Driven Decision Making for Teachers **	COE/TED	Fall 2016	Fall 2017
	TED 8030	STEM Innovations**	COE/TED	Fall 2016	Fall 2017
Phase III	TED 8010 /CSCI 8##0	Electives **	COE/TED CIST/CS	Spring 2016	Spring 2017
	CSTE 8910	MS Capstone	CIST/CS	N/A	Spring 2018
	CSTE 8960 /TED 8960/	MS Project	CIST/CS COE/TED	N/A	Spring 2018
	CSTE 8970 /TED 8970/	Independent study	CIST/CS COE/TED	N/A	Spring 2018
	CSTE 8990 /TED 8990	MS Thesis	CIST/CS COE/TED	N/A	Spring 2018

* New course and online delivery development

** Existing course that will be redesigned for online delivery

Administration of the program:

A Graduate Program Committee (GPC) consisting of six members (four from CS and two from TED) will be formed for the proposed MS-CSE program. Members serving the committee will be recommended by the Chairs of the Computer Science and Teacher Education Departments, and approved by the Dean of Graduate Studies (delegated by the Graduate College, University of Nebraska). The Computer Science Department Chair will recommend one of the members to serve as the committee chair. The committee will supervise the day-to-day operations including student admission evaluations, recommendations for admissions, assignment of mentors to students, approval of students' study plans, assessment of students' progress, course offerings and schedules, learning outcome assessment, curriculum revision, and continual improvement of the program.

An existing staff member, shared with other graduate programs in the colleges, will be identified to serve as the student advisor of the program. The advisor will assist the GPC in performing administrative tasks, and will serve as the first point of contact when the students apply, or are admitted to the program.

3. **Faculty, Staff, and other Resources** (Current resources and additional resources needed first five years and long term):

3.1 Additional physical facilities needed:

The proposed MS-CSE program is built on the strong educational infrastructures, research resources, and successes of existing programs in the College of Information Science & Technology; the Department of Teacher Education; the Peter Kiewit Institute of Information Science, Engineering, and Technology; the College of Engineering, and its Office of STEM Education initiatives.

Existing faculty resources, including faculty member Briana Morrison who has been hired effective Fall 2016 through internal funding reallocation by the Office of Academic and Student Affairs, will be sufficient to launch and stabilize the program. However, we anticipate that as the program is expanded and offered online, we will need to add faculty lines and graduate assistantships to accommodate the growing market need and student demands for a regional and nationwide reach. The funds for additional faculty position(s) and graduate assistantship(s) would likely come from the distance education tuition revenue, and can be in place starting the fifth year of the program operation, depending on program growth.

3.2 Instructional equipment and informational resources:

While no additional instructional equipment is requested for the proposed program, for successful operation of the MS-CSE program, multiple channels and models will be sought to support the MS-CSE students with partial and total tuition coverage from the following potential sources:

- School districts for reimbursement of tuition cost for their in-service teachers.
- Special funds created by businesses (e.g. the Omaha Chamber of Commerce) to support in-service teachers.
- Scholarships established by private donors and foundations. There are preliminary indications that many Omaha and Nebraska philanthropists and organizations have an understanding of the urgency of promoting computer science education in K-12, and are willing to provide financial support to promote computer science education in K-12 schools.
- Paid summer internships for the purpose covering tuition fees.
- Financial federal and state support to partially offset the tuition cost for in-service teachers (e.g. grants from NSF programs and Department of Education).

- School incentives such as reduced teaching load for in-service teachers enrolled in the MS-CSE program.

3.3 Budget projections

The following types of costs for the Phase I development (first five years) of this program are anticipated:

- New course development: CSTE 8020, CSTE 8030, TED 8006, and CSTE 8040.
- Course redesign for online delivery: CSCI 8010, CSCI 8366.
- Funds for software licenses for the tools used in the online courses (for supporting synchronous meetings, group collaboration, document sharing, screen sharing, and other activities).
- Marketing expenses for development and dissemination of promotional materials.
- Expenses for piloting a secure online/remote testing service, e.g., commercial educational tools - Software Secure, and Kryterion.
- One graduate faculty for task coordination, course development, and initial delivery of the program (search has begun for this position to start Fall 2016).
- One graduate assistant to support the delivery of the courses and the program (reallocated from existing College of Information Science and Technology GAs or from OASA new GA request process.

A request of funds from the University of Nebraska System's Online Worldwide (OWW) grants for $35,000 was awarded in spring 2014 for the support of Phase I (planning and course development) of the proposed MS-CSE program. The grants will fund the development and delivery of the first seven online courses for the program. Courses are expected to remain current for two to three years once developed, after which they will need to be redesigned. These courses will require continuous funding and support, similar to other distance learning courses.

The ability to offer this MS-CSE degree programs via online distance education is expected to significantly increase the attractiveness of the program to potential students, and help to build and sustain the operations of the program.

More information on budget projections of the proposed MS-CSE program is attached in the revenue and expenditure format using the approved CCPE budget table.

4. Evidence of Need and Demand:

A number of recent reports have raised attention about the lack of high quality opportunities for K-12 students to engage with computing, computer science and information technology early in their educational experiences (Donna George 2014). For example, the 2010 Running on Empty report (jointly prepared by the Association for Computing Machinery – ACM, and the Computer Science Teachers Association - CSTA) details the paradoxical increase in IT's importance in modern society along with a 17% decrease in access to pre-AP computing courses and a 35% decrease in access to AP CS courses at the secondary level nationwide since 2005 (Wilson et al., 2010).

In nearly every state, IT and CS courses do not fulfill state graduation requirements and no specific teacher certification is available or required (Lang et al., 2013). The lack of computer science instruction is significantly a national issue, as highlighted by the recent Washington Post article: *High school students are all about computers but get little instruction in computer science* (Donna George 2014), though nationwide curricular frameworks and standards exist (CSTA 2011), and teaching the material therein clearly requires specialized training in Computer Science content.

The lack of high quality elementary and secondary experiences in computing directly limits the number of students opting to pursue CS and other IT-related majors at the undergraduate level in University of Nebraska colleges. This is a significant pipeline problem and hinders Nebraska's nationwide competitiveness in the IT job sector, which is estimated to grow by 1.4 million jobs by 2020 according to the Bureau of Labor Statistics data. By 2020, one of every two STEM jobs will be in computing (Kaczmarczyk and Dopplick, 2014). Making a sustainable, systemic change requires a significant increase in the number of high-quality, well-trained IT teachers in U.S. schools. In response to this need, the National Science Foundation began the CS10K initiative (Astrachan et al., 2011; Franke et al., 2013) to train 10,000 new secondary-school computer science teachers to effectively teach a new curriculum that engages students in meaningful computational thinking (Wing, 2006) by 2015. While strides have been made towards increased teacher professional development nationwide, the U.S. is still a long way from achieving this ambitious goal (Cuny et al., 2014).

Nebraska has few specifically designated K-12 CS teachers, no required training in CS in order to teach computing courses (Wilson et al., 2010; Lang et al., 2013; Kaczmarczyk and Dopplick, 2014), no standardized high school CS curricula - and compared to other states, only relatively few students taking the AP CS exam. Most state-recognized IT courses are taught by teachers with only Business or Mathematics primary endorsements, resulting in courses (including AP Computer Science) being offered by instructors with at best one college level course in computer science. Thus many teachers are under-prepared to engage students meaningfully in IT coursework. One indicator of this can be seen in the AP exam statistics for Nebraska: Over 10,000 Nebraska high school students took AP exams in 2014, but only 71 students took the AP CS A exam (College Board, 2014).

At the same time, Nebraska is experiencing considerable growth in the information technology sector. A recent report from the Omaha Chamber of Commerce conservatively projects that there will be over 1,300 new IT job openings in the Omaha metro area in the next two years alone (Vaslow, 2013). Nebraska desperately needs to address the lack of systemic CS participation at the elementary, middle and secondary school levels to meet the demands of the local economy development and progress, and enable children to be competitive on the national and international job market.

The MS-CSE program planning group has worked together closely for the past three years on several STEM-education projects related to Computer Science for K-16 students and teachers in Nebraska and western Iowa. The K-12 teachers who have participated in these projects have expressed a great deal of interest in taking graduate coursework that would enable them to better teach computer science courses at their schools. Their feedback and enthusiasm has, in part, motivated this proposal. The undertaking of graduate coursework, particularly in the areas of computer science content and pedagogy, that is as systematical and as relevant as possible to their instructional responsibilities in their schools, will enable the teachers to design and deliver high quality CS Education programs more effectively.

Based on the National Science Foundation's CS10K initiative and its goal to have rigorous academic curricula incorporated into computing courses in 10,000 high schools, taught by 10,000 well-trained teachers - the Department of Computer Science and the Department of Teacher Education estimate that over 100 CS teachers in Nebraska could comprise a pool of potential students for this program. (This is a conservative estimate in terms of the number of school districts and schools in Nebraska).

Based on the number of K-12 enrollments in the Nebraska and Midwest regions, and the requests to training and staffing teachers for offering computer science courses to this population, both the initial demand and the potential growth of the proposed MS-CSE program is substantial (Taylor and Miller, 2015). In the surrounding eight-state area, the potential demand could exceed 1,000 students. Assuming 50 Nebraska teachers and 250 teachers from surrounding Midwestern states would enroll in the program (for endorsement, certificate, and/or the entire MS-CSE degree), an immediate audience of 300 teachers is

estimated to have the potential to enroll in the proposed MS-CSE program within a five year cycle. In addition, the online delivery nature of the program will allow the College of Information Science & Technology to reach out on a national scale, and therefore another 250 teachers could also be added to the overall estimate.

Capacity

The Department of Computer currently has 19 full-time faculty members, including a new Union Pacific Community Chair of Computer Science Education, held by Dr. Brian Dorn. Dr. Dorn is an Assistant Professor and specialist in computer science curriculum development and education. The UNO Department of Teacher Education (TED) within the College of Education has 30 full-time faculty members. The UNO Office of STEM (OSTEM) Education is based in TED and helps to coordinate the STEM priority on campus, including this proposed MS-CSE program.

Based on the current faculty which consists of eight core faculty (four from each department of Computer Science and Teacher Education) - the program can accommodate 30-35 students as an optimum size per year in the initial years of this program. We estimate that the minimum number of students required to make the program viable will be around 10 per year.

Additional resources, mainly faculty positions and graduate assistantships, will be needed to accommodate the growing market need and student demands for a regional and nationwide reach. If additional resources (assuming two faculty and two graduate assistantships) become available, the program can serve up to 50-60 students annually (which may still not fully meet the market need and student demand).

Goals for program growth over a six-year period

Based on the above estimate of program demands and optimal program size, the MS-CSE program is expected to grow rapidly in the first six years. The following table projects the goals for program growth over a six-year period.

	Acad. Year	New Admits	Graduates*	Total in Program
Year 1	2016 – 2017	4-5		4-5
Year 2	2017 - 2018	6-8		10-13
Year 3	2018 - 2019	10-12	2-3	18-22
Year 4	2019 - 2020	14-20	6-8	26-34
Year 5	2020 – 2021	14-20	10-16	30-38
Year 6	2021 - 2022	14-20	14-20	30-38

* Considering most of the students (in-service teachers) will pursue this degree program part-time, it will take three to four years to complete the 30 credit hours requirement to graduate.

If the program has the demand expected after three to four years, and additional funds become available to support additional faculty and graduate assistants, more students will be enrolled and graduate from the program.

The above estimates are for core MS-CSE students only. Students enrolled in other graduate degree programs, e.g., Mathematics, Science, Teacher Education and STEM education, could certainly elect to

take one or two courses in the MS-CSE program as part of their degree program. A minimum of an additional 10 students per year is estimated to come from other degree programs, especially since the participating TED faculty will facilitate in the advising of many potential students.

5. **Partnerships with Business and Community Partners**:

The program will leverage numerous collaborative activities between the UNO Computer Science and Teacher Education Departments and area K-12 schools that include:

- A Research Experience for Teachers (RET) Site grant funded by the National Science Foundation (NSF) from 2012 to 2015. This involves over 100 teachers in summer projects and follow-up workshops Momentum. Collaborative partnerships with K-12 teachers established through the RET project will be leveraged as a springboard to start this degree program;
- Two Computer Science for High Schools (CS4HS) projects funded by Google, Inc. in 2012 and 2013, attended by more than 60 teachers in summer workshops. The project established solid connections between the UNO faculty and the STEM teachers statewide and laid a foundation for the demand of the proposed MS-CSE program;
- Annual CS Education Week activities (since 2009) for area high schools, including quiz bowl and programming contests, that involve over 150 students and over 30 grade 9-12 teachers as team coaches;
- An Innovative Technology Experiences for Students and Teachers (ITEST) grant funded by the National Science Foundation from 2015 to 2017, which will train a cohort of 72 teachers from grades 6-9 in the basics of Computer Science. This leverages the momentum of the RET and CS4HS projects by providing more systematic training and comprehensive year-round support for teachers introducing computing-related lessons to their classrooms; and
- Formation of the Omaha Metro Computer Science Teachers Association (CSTA) chapter, initiated by the NSF RET faculty team and several RET participating teachers. Faculty involved in the proposed MS-CSE program have also served as CSTA chapter advisers, and have already co-organized several activities. The CSTA chapter will help promote the new degree program, and we expect several CSTA members as the first cohort to enroll in the program.
- Techademy (K-12), CodeCrush, and iSTEM after School – These three programs directly engage middle and high school students and teachers in Nebraska and surrounding states in computing education and training.

6. **Collaborations within the University**:

The proposed MS-CSE is a joint degree between the Department of Computer Science and the Department of Teacher Education, thus will require continuing collaboration between the departments in the College of Information Science & Technology and the College of Education.

In addition, the proposed MS-CSE program will open a new path for the Computer Science Department to collaborate with the two other units of the college – the Department of Information Systems and Quantitative Analysis (ISQA) and the School of Interdisciplinary Informatics (IS2). The proposed MS-CSE program will strengthen and enrich the ISQA and SI2 programs in terms of (1) additional data sharing in the emerging areas of information technology; (2) new pedagogical techniques that will be developed in the MS-CSE program and will become available to all college instructors; and (3) the increased diversity of the college's student body. Collaboration will focus on instructor training, core extension courses, and foster more interdisciplinary research and outreach.

7. **Collaborations with Higher Education Institutions and Agencies External to the University**:

The College of Information Science & Technology has a number of collaborations with governmental and nongovernmental agencies that support the efforts relating to computing education efforts in Nebraska and the United States. Some of these collaborations are highlighted below.

Engagement with the K-12 community is reflected in the following ways:

- Dual enrollment programs with high schools – IS&T offers eleven (11) computing classes for dual enrollment including CS Principles and Introduction to Computer Science.
- Teacher Training – IS&T faculty have offered professional development and training to teachers through short courses, grant-funded (e.g., NSF iTEST) summer training, and regular courses.
- Community outreach – IS&T has a number of community initiatives that have a bearing on this proposal such as Codecrush (immersion experience for girls and their mentor teachers), iSTEM after school (educational workshops in out of school time space), and Techademy (summer workshops for middle and high school students).
- Collaborations with community colleges – The college has articulation agreements in computer science with every community college in Nebraska and the Iowa Western Community College in Council Bluffs, IA where students can participate in a 2+2 engagement allowing them to complete their first two years in the community college.
- Collaboration with Nebraska Department of Education (NDE) and the NE State Board of Education regarding a proposal to count computer science courses as a high school graduation requirement.

8. **Centrality to Role and Mission of the Institution:**

The proposed MS-CSE program supports numerous goals, sub-goals and objectives of the University of Nebraska, UNO, the College of Information Science & Technology, and the College of Education, as well as the collaborating Department of Computer Science and Department of Teacher Education, as noted below:

- The proposed MS-CSE program will be available to K-12 teachers in Nebraska and multiple locations using flexible delivery methods and course formats that will "increase accessibility and adaptability of academic programs consistent with student demand and resource availability" (UNO Strategic Plan, Goal 1; Sub-Goal A; Objective 4).
- The proposed MS-CSE program enhances and furthers UNO's goal of national recognition, innovation and leadership in STEM education. UNO has recognized the importance of STEM as being critical to its metropolitan university mission, and has designated STEM as one of five campus priority areas (See Campus Priorities: Charting a Clear Vision for 20/20, UNO, February 2012).
- The proposed MS-CSE program directly helps UNO to "enhance graduate program pathways to support STEM leadership within P12 schools" while also expanding distance education course offerings available to MS-CSE students and other STEM-focused graduate students from the College of Information Science & Technology and College of Education (See UNO STEM Strategic Plan Objectives 1.10 and 1.11).
- The proposed MS-CSE degree program will, in part, fulfill the mission statements of the Department of Computer Science "to provide outstanding undergraduate and graduate education in computer science;" and "to integrate our educational, research, and service activities with other programs in the college and the university and with the communities we serve to reflect the role of computer science in information science and technology." (See CS department Strategic Plan – Mission and Vision Statements, http://cs.unomaha.edu).

- The proposed MS-CSE program aligns well with the mission, vision, and strategic plan of the UNO College of Education, which works closely with discipline-based faculty across UNO to offer teacher certifications, and degrees that combine content and pedagogy preparation for teachers. This proposed MS-CSE program will open a new path for the CS and TED collaboration and will help teachers to get CS content and pedagogy graduate coursework that will allow them to also move forward on their district salary schedule. The curriculum of all UNO TED programs are fully accredited by the National Council for Accreditation of Teacher Education (NCATE) and the Nebraska State Department of Education.
- The OSTEM faculty in TED are very successful with the engagement of schools and teachers, as well as professional organizations in Nebraska, including the Metropolitan Omaha Educational Consortium's (MOEC), the Nebraska Educational Technology Association (NETA), the Nebraska Association of Science Teachers (NATS), and the Nebraska Association of Teachers of Mathematics (NATM), to name just a few. Estimates suggest that OSTEM works annually with more than 1,800 teachers around Nebraska and the U.S. in various activities, and more than 8,000 K-12 students statewide and nationally in various TED OSTEM-supported projects and efforts. OSTEM faculty members also are responsible for a yearly average of $500,000 of external funding being brought into UNO for STEM education efforts.
- For the Department of Teacher Education and the College of Education, this collaborative effort supports the long-term interests of working closely with STEM content faculty and their colleges to ensure that teachers have access to the very best content and pedagogical coursework possible, in order to continue to contribute to the excellence of K-12 classrooms in Omaha, Nebraska, and the nation.

9. Consistency with the University of Nebraska Strategic Framework:

The proposed MS-CSE degree program builds upon the University's strategic focus[3] on excellence in graduate education by implementing a niche graduate program that addresses an important local, national and international need. This program will further highlight the University of Nebraska as a regional, national, and international leader in Information Technology (IT) related education, and in particular computer science teacher education. This is well aligned with the long-term interests of the University of Nebraska and its strategic goal to build a talented, competitive workforce while pursing excellence through targeted programs (strategic Goals 2b and 3). Additionally, the degree will afford many opportunities to in-service teachers to develop lifelong educational opportunities through online graduate coursework in computing education (Goals 1d and 1g). The program also aligns with Goal 5 in that the faculty, staff and students in the program are directly engaged with the K-12 computing and STEM teacher community in Nebraska.

10. Avoidance of Unnecessary Duplication:

The proposed MS-CSE degree program complements an existing online Master of Science in Education-Instructional Technology degree program offered by the University of Nebraska at Kearney (UNK). UNK currently offers an Information Technology (IT) concentration, which comprises 12 hours of Teacher Education core courses (e.g., Ethics, Educational Research), 9 hours of Instructional Technology core courses (e.g., Developing Web-based Portfolios), and 15 hours of IT Concentration (e.g., Database Systems, IT Teaching Methods, System Administration).

The proposed MS-CSE program devotes significantly more contact hours to computing content and teaching (including computer programming) in its curriculum, which is the core for IT development and applications, while UNK's more broadly defined program concentrates on the use of information

[3] http://nebraska.edu/docs/StrategicFramework.pdf

technology in classrooms. The MS-CSE program has a more focused computing core which also enables the students to take advantage of the breadth of expertise and resources available within the College of Information Science & Technology, the Teacher Education Department, and within the international computing education community more effectively. For example, the proposed MS-CSE program will provide a seamless integration of newly developed CS curricula of national standard (ACM/IEEE CS Curricula 2013), advanced technology and novel pedagogy as exemplified in courses such as Computer Science Principles and Exploring Computer Science for Teachers. Integrated learning of content knowledge embedded alongside the instructional strategies with which to teach is needed to develop teacher's pedagogical content knowledge (Shulman 1986) and best prepare teachers for today's classrooms. Unfortunately most current teacher training experiences focus either solely on content or teaching methods independently (see, e.g., Saeli et al. 2012). The Department of Computer Science and the Department of Teacher Education believe that a careful blend of content and pedagogy in computer science education is vitally important since any graduate program seeking to address the shortage of qualified CS teachers must accommodate the potential for students that have little prior content knowledge in computer science and little (if any) experience teaching computing at the outset.

The Information Technology (IT) Supplemental Teaching Endorsement part of this proposed MS-CSE degree program complements another IT Supplemental Teaching Endorsement pathway previously established in 2014. However, that endorsement program is designed at an undergraduate level and is targeted to **pre-service** teachers who are currently working on their Bachelor's degree in education, while the proposed MS-CSE program is more tailored towards **in-service** teachers who have already obtained a Bachelor's degree and have teaching certificates in areas other than computer science and information technology. The course requirement for the IT supplement teaching endorsement at the undergraduate level includes TED 4000, CSCI 1200, CIST 1300, CIST 1400, CSCI 1620, CIST 2850, CIST3350 or CIST 3370 or CSCI3550, which are all at the undergraduate level; while the courses for the proposed MS-CSE degree program are all at graduate level.

After a careful search, the University of Nebraska at Omaha is unaware of any other similar face-to-face or online degree programs in the eight-state region surrounding Nebraska (Iowa, South Dakota, North Dakota, Minnesota, Kansas, Missouri, Colorado, and Wyoming). Although the Master of Science in Computer Science is commonly offered, we found no other program that is specifically designed as a M.S. in *Computer Science Education*. The aforementioned UNK program *is a concentration, not an entire degree program.* Dakota State University (Madison, South Dakota) offers a Bachelor of Science in Computer Education (http://www.dsu.edu/majors-programs/computer-education.aspx), but it is not a graduate degree program, nor is it offered online. In addition, research of higher education institutions nationwide did not turn up any substantially similar programs to the proposed MS-CSE program either.

11. Consistency with the Comprehensive Statewide Plan for Postsecondary Education: how this program would enhance relevant statewide goals for education:

The proposed program is responsive to the Nebraska *Comprehensive Statewide Plan for Postsecondary Education*, in particular that "[e]ach higher education institution will fulfill its role and mission with distinction by being responsive to changing academic, workforce, societal, economic, and community development needs." As mandated by the Nebraska *Comprehensive Statewide Plan for Postsecondary Education*, "[h]igher education has an important role in supporting the State of Nebraska's economic development goals by contributing to a competent and competitive workforce for our state and by ensuring lifelong learning and training opportunities for our citizens." There is a growing critical demand for STEM-educated graduates to fulfill workforce, economic, societal, academic, and community demands.

The State of Nebraska and the University of Nebraska system have embraced STEM education reform by supporting initiatives and special projects at all levels of K-16 education. At UNO, this support of STEM has included the establishment of STEM as a campus priority, the development of a detailed STEM Strategic Plan, the establishment of four endowed Community Chairs supporting STEM Education, and the creation and operational support of a STEM Leadership Committee of faculty and administrators. The creation of the proposed MS-CSE is an essential next step in UNO's commitment to STEM education.

As indicated by the Nebraska *Comprehensive Statewide Plan for Postsecondary Education*, "Nebraska's school teachers are one of the state's greatest assets. By many measures, achievements of Nebraska elementary and secondary students consistently rank among the highest in the nation. Teachers exert a profound influence on students' lives. Yet many school districts are finding it difficult to attract and retain qualified teaching staff ..." There is a critical need for trained teachers at the K-12 level who are well prepared to teach computer science and computational courses, e.g., Advanced Placement Computer Science, that are sorely needed to build a steady pathway of undergraduate students to meet the demands of the IT job sector in Nebraska and nationwide. This proposal builds on numerous projects with Nebraska teachers and school districts undertaken by the proposed faculty team, as described herein. It also amplifies the Major Statewide Goal for "the workforce development and ongoing training needs of employers and industries to sustain a knowledgeable, trained and skilled workforce in both rural and urban areas of the state." The proposed degree program has the strong support of the schools and communities statewide – and adheres to the Nebraska *Comprehensive Statewide Plan for Postsecondary Education*, in particular that "[h]igher education will work effectively with elementary and secondary schools to improve teaching and learning at all levels of education and to facilitate the transition from one level of education to another."

In addition, as indicated by the Nebraska *Comprehensive Statewide Plan for Postsecondary Education*, "[a]s more adults remain in the work force, there will be a continuing need for access to life-long learning and retraining opportunities." Particularly, "[i]nstitutions will develop new strategies and support programs for attracting and retaining adult students who need new skills and training, many of whom will enroll part-time and take courses via distance education technology." Courses in the MS-CSE program will be delivered using online and blended learning methods, as well as innovative synchronous and asynchronous approaches. The online and blended delivery nature of the courses will enhance the attractiveness of the MS-CSE program to potential students in the region of its reach, and provide essential growth and sustainability of the program.

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De Blasio to Announce 10-Year Deadline to Offer Computer Science to All Students

The New York Times (09/15/15) Kate Taylor; Claire Cain Miller

New York City Mayor Bill de Blasio has announced that all of the city's public schools will be required to offer their students computer science classes within a decade. The main challenge of fulfilling this mandate is training enough educators, given the lack of a state teacher certification in computer science

and no pool of computer science teachers among college graduates. New York City plans to invest $81 million over 10 years on this effort, with 50 percent of that budget raised from private sources. The project will require training an estimated 5,000 teachers. "I think there is acknowledgment that we need our students better prepared for [tech] jobs and to address equity and diversity within the sector, as well," says New York City Office of Strategic Partnerships director Gabrielle Fialkoff. Unlike a similar program in Chicago, the New York City initiative is not planning to make computer science a graduation requirement. Meanwhile, San Francisco's Board of Education in June voted to offer computer science education from prekindergarten through high school, and to make it mandatory through eighth grade. "The difficulty is getting enough teachers who are trained in it, and trained well enough to make it a good introduction to computer science," says Barbara Ericson, the director of computing outreach at the Georgia Institute of Technology's College of Computing.

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APPENDIX A: PROPOSED MS-CSE COURSE DESCRIPTIONS

- **TED 8006: Methods of CS Education (3 credit hours)**

  This course is designed to develop knowledge, skills, and dispositions requisite of teachers. Course content is determined by the discipline area and for some content areas a field experience will be required. It introduces the teacher to the unique challenges and obstacles in the IT classroom and is necessary for teachers to effectively teach the wide range of IT-related courses.

  Prerequisite: Admission to Teacher Preparation Program

  Cross-listed as: TED 4000.

  Rationale: This course will provide pedagogical content knowledge through exploration of evidence/research-based pedagogical best practices for the IT/Computing classroom.

- **CSTE 8020: Exploring Computer Science for Teachers (3 credit hours)**

  This course provides a breadth-first exposure to the content and pedagogy needed to teach the Exploring Computer Science secondary school curriculum (Goode and Chapman, 2013). It provides a broad introduction to human-computer interaction, problem solving, web design, basic programming constructs, computational data analysis, and robotics. In addition to content knowledge, students will learn how to integrate and assess hands-on projects related to these topics in secondary classroom environments.

  Prerequisite: None. No prior experience in computer science or programming is required.

- **CSTE 8030: Computer Science Principles for Teachers (3 credit hours)**

  This course exposes students to the content and pedagogy needed to develop and teach high school courses that conform to the Advanced Placement CS Principles Curriculum Framework (College Board, 2013). Through a combination of lecture and hands-on lab experiences this course explores essential questions related to seven overarching ideas in computer science including: creativity, abstraction, data and information, algorithms, programming, the Internet, and global impact. In addition to experience with content knowledge, this course will prepare students to create comprehensive lesson plans addressing CS Principles and devise authentic forms of assessment for measuring learners' progress in secondary school settings.

  Prerequisite: None. No prior experience in programming is expected.

- **CSTE 8040: Object Oriented Programming for Teachers (3 credit hours)**

  This course provides an in-depth treatment of the fundamentals of object-oriented programming (OOP) in a text-based programming environment. Topics include data types and information representation, control structures, classes and objects, methods, encapsulation, inheritance and polymorphism, and use of introductory data structures to solve real-world problems. Additionally, this course interleaves coverage of OOP content with discussion of common learner misconceptions and teaching strategies/tools that can be employed to aid learners' mastery of this material. This course prepares students to implement the Advanced Placement Computer Science A curriculum in a secondary school setting.

  Prerequisite: CSTE 8020 or CSTE 8030

- **CSCI 8366: Foundations of Information Assurance (3 credit hours)**

  Contemporary issues in computer security, including sources for computer security threats and appropriate reactions; basic encryption and decryption; secure encryption systems; program security, trusted operating systems; database security, network and distributed systems security, administering security; legal and ethical issues.

  Prerequisite: CSCI 8010

  Cross-listed as: IASC 8366 and IASC 4360.

- **CSCI 8836 Software Engineering (3 credit hours)**

  Basic concepts and major issues of software engineering, current tools and techniques providing a basis for analyzing, designing, developing, maintaining and evaluating software systems. Technical, administrative and operating issues. The course will cover the privacy, security and legal issues of software development.

  Prerequisite: 8010

  Cross-listed as: CSCI 4830.

- **CSCI 8256: Human-Computer Interaction (3 credit hours)**

  This course consists of topics related to the design, implementation, and evaluation of human-machine systems. Topics include the joint performance of tasks by humans and machines; user psychology (attention perception, cognition, metaphors, learning); ergonomics; advanced interfaces (virtual reality, adaptive interfaces); low and high fidelity prototyping methods and evaluation methods.

  Prerequisite: CSCI 8010

  Cross-listed as: CSCI 4250.

- **CSCI 8010: Foundations of Computer Science (3 credit hours)**

  This is a foundational course for students enrolled in the graduate program in computer science. The objectives are to introduce students to a large body of concepts so that they are better prepared for undertaking the core courses in the graduate program. It is assumed that student would have programmed in a high-level language and have exposure to basic college level mathematical concepts such as logarithms, exponents, sequences, and counting principles.

  Prerequisite: There are no pre-requisite courses to take this course. Students are expected to have written programs using some high-level programming language. Students should be familiar with basic mathematical concepts including exponents, logarithms, sequences, and counting principles.

- **TED 8000: Data Driven Decision Making for Teachers (3 credit hours)**

  This course provides graduate students with hands-on experiences that model data driven decision making for building educational success in today's classroom. Graduate students learn how to create valid and reliable assessments, to interpret standardized test data, build data models that identify student, classroom, program, and school needs, and in general, to systematically enhance educational decision making from a base of carefully collected information. Graduate students also explore data collection and analysis strategies associated technologies such as cloud computing, tablet computers and smart phones, as well as to experience data driven decision making models that can be integrated

into student lessons as well, to not only teach more effectively with data driven decisions, but to also be able to teach about data driven decision making to students.

Prerequisite: Permission of Graduate Adviser.

- **TED 8030: STEM Innovation (3 credit hours)**

  This course examines curriculum innovation strategies associated with STEM focused coursework and how to integrate disciplines for the instruction of key topics. Computer science applications and their utility for interdisciplinary teaching across the STEM disciplines is a key topic in the course. Computer science is referenced as the potential for being a school's driver of STEM innovation. Graduate students also do a significant written document or article in this class conceptualizing STEM innovation that might occur within their own instructional environment, and which is commonly used by students for writing samples for admittance into future doctoral work.
  Prerequisite: Permission of Graduate Adviser.

- **CSCI 8910 MS Capstone (3 credit hours)**

  The capstone course is to integrate coursework, knowledge, skills and experimental learning to enable the student to demonstrate a broad mastery of knowledge, skills, and techniques across the Master's degree curriculum of Computer Science for a promise of initial employability and further career advancement. The course is designed to be in a student-centered and student-directed manner which requires the command, analysis and synthesis of knowledge and skills. Students may apply their knowledge and skill to a project which serves as an instrument of evaluation. Students are encouraged to foster an interdisciplinary research and cultivate industry alliances and cooperation in this course.
  Prerequisite: Permission of Graduate Adviser.

- **CSCI 8960 Thesis-Equivalent Project, or TED 8100 Research Project (1-6 credit hours)**

  This course allows a graduate student to conduct a research project in computer science or a related area. The project is expected to place an emphasis on applied, implementations-based, or experimental research. The process for development and approval of the project must include: appointment of supervisory committee (chaired by project adviser), a proposal approved by the supervisory committee, monitoring of the project by the supervisory committee, an oral examination over the completed written product conducted by the supervisory committee, final approval by the supervisory committee. The approved written project will be submitted to the Office of Graduate Studies by the advertised deadlines.

  Prerequisite: Permission of Graduate Adviser.

- **CSCI 8970 Independent Study, or TED8970 Independent Study (3 credit hours)**

  Under this number a graduate student may pursue studies in an area that is not normally available in a formal course. The topics to be studied will be in a graduate area of computer science to be determined by the instructor.

  Prerequisite: Permission of the Graduate Program Committee.

- **CSCI 8990 Thesis, or TED8990 Thesis (1-6 credit hours)**

  A research project designed and executed under the supervision of the chair and approval by members of the graduate student's thesis advisory committee. In this project the student will develop and perfect a number of skills including the ability to design, conduct, analyze and report the results in writing (i.e., thesis) of an original, independent scientific investigation.

  Prerequisite: Permission of Graduate Adviser.

- **Approved electives: CSCI 8##0 or TED 8##0 (3 credit hours)**

  Selective among graduate courses offered in Master of Science in Computer Science and Master of Science in Teacher Education programs.

  "#" means any number from 0 to 9.

APPENDIX B: RULE 24 MATRIX FOR INFORMATION TECHNOLOGY (IT) SUPPLEMENTAL TEACHING ENDORSEMENT

Rule 24 Matrix
_____Revised Program

Table of Alignment of Standards and Assessments

Name of Institution: University of Nebraska at Omaha
Date Submitted: DRAFT

Endorsement: **INFORMATION TECHNOLOGY**
Total Hours Required by Rule 24: 15

Program Hours Required by Institution: 15

Grade Levels: **PK-12**
Endorsement Type: **SUPPLEMENTAL**

Endorsement Program Requirements: Nebraska teacher education institutions offering this endorsement program must have on file, within the institution, a plan which identifies the courses and the course completion requirements which the institution utilizes to grant credit toward completion of this endorsement.

006.34D **Certification Endorsement Requirements:** This endorsement requires a minimum of **15 semester hours** in information technology courses.

List all required courses, with credit hours, in the first row: (If more than 35 courses please fill out additional sheets)
Content courses (addressing the XX hours) should be listed first

Place an X in the box corresponding to the course that meets the following requirements:	**EXAMPLE: CHEM 101 or 102 3 CR**	CSED 8020 or CSED 8030	CSED 8040	CSCI 8366	CSCI 8866 or CSCI 8256	TED 8006																											
S1. Demonstrate knowledge of ethical, human, legal and social issues, which may include privacy, accessibility, copyright, intellectual property, plagiarism, and information validity.		X		X		X																											
S2. Demonstrate knowledge of classroom and instructional management methodologies using appropriate materials, methods, resources, and curricula for teaching information technology, which may include:																																	
E1. Instructional strategies that create authentic and meaningful learning experiences;		X	X	X	X	X																											
E2. Instructional strategies for dealing with learning styles and diverse populations; and		X	X			X																											
E3. Effective methods of assessment and evaluation with appropriate feedback techniques.		X	X			X																											
S3. Demonstrate knowledge of methods and skills appropriate to planning and designing learning environments, which may include:																																	
E1. Classroom design that includes access to technical resources and tools; and		X	X			X																											
E2. Management skills and techniques.		X				X																											

Place an X in the box corresponding to the course that meets the following requirements:	EXAMPLE: CHEM 101 or 102 3 CR	CSED 8020 or CSED 8030	CSED 8040	CSCI 8366	CSCI 8866 or CSCI 8256	TED 8006																																
S4. Demonstrate knowledge and application of basic programming concepts, that may include:																																								
E1. Design principles and common programming structures;		X	X		X																																			
E2. Procedural and object-oriented programs;		X	X																																					
E3. Application development tools;		X	X		X																																			
E4. Program solutions coded in a common high-level language; and		X	X																																					
E5. Strategies for testing and debugging code.		X	X																																					
S5. Demonstrate knowledge in the areas of selection, installation, management, and maintenance of infrastructure for information support and services, which may include:																																								
E1. Operating systems;				X																																			
E2. Organization and architecture of computer systems and software;				X																																			
E3. Database design, development, and management;		X																																					
E4. Technical research and documentation;			X		X																																		
E5. Troubleshooting strategies;		X	X	X	X																																			
E6. Communication skills;		X	X		X	X																																		
E7. Emerging hardware and software technologies;		X		X	X	X																																		
E8. Security of hardware, software, and data; and				X																																			
E9. Ergonomic principles that foster a healthy and productive environment.					X	X																																		
S6. Demonstrate a basic knowledge of interactive media, which may include:																																								
E1. Web-based media and applications;					X																																		
E2. Multimedia tools; and		X			X?																																		
E3. Digital media.		X			X?																																		

| Place an X in the box corresponding to the course that meets the following requirements: | EXAMPLE: CHEM 101 or 102 3 CR | CSED 8020 or CSED 8030 | CSED 8040 | CSCI 8366 | CSCI 8866 or CSCI 8256 | TED 8006 | | |

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3/14/2014

Qiuming Zhu, PhD
Computer Science--281D PKI
University of Nebraska at Omaha
6001 Dodge Street
Omaha, Nebraska 68182

Dear Dr. Zhu

My name is Derek Babb. I teach Computer Science at Bellevue East High School and am also the president of the Omaha Computer Science Teachers of America (CSTA) chapter. In the past I have worked with UNO's Computer Science department in a number of roles both as an advisor to students and as a project participant myself.

As a computer science teacher in the Omaha metro area, I am very interested in a master degree program for Computer Science Education. In education, it is rare that a teacher has an undergraduate degree in their content area. Most teachers have a bachelor's degree in Education and an emphasis or concentration in their content area (Math, English, CS, etc.). As a result, teachers are often not in a position to get a master's degree in their content because they lack the prerequisites.

Most of the areas have content specific master's degrees that are designed specifically for teachers. These courses not only make a teacher more capable and competent in their content, but they also focus on pedagogy and best practices in teaching that particular content. Computer Science teachers routinely run into a wall once they have an undergraduate degree. Master programs tend to exclude teachers and focus strictly on CS. The lack of pedagogy classes in concert with CS courses mean that we are not making teachers better. This is a vital need as we look to expand CS offerings in middle and high schools.

In my work with the CSTA, we are trying to lobby our State Board of Education to accept CS courses as either a math or science credit. A big challenge is proving the teachers in the classrooms are teaching a rigorous class that warrants this distinction. Creating a way for teachers to become masters in the content and pedagogy is a necessary component to moving forward as a professional organization of CS teachers.

I am excited about the prospect of this program at the University of Nebraska – Omaha and look forward to its implementation.

Sincerely,

Derek Babb
Computer Science Teacher
Bellevue East High School

March 17, 2014

Douglas Bertelsen
Science Department
Gretna High School
11335 S 204th Street
Gretna, NE 68028

Dear Sir or Madam

I would like to voice my support for the University of Nebraska at Omaha's proposed Master's of Science in Computer Science Education degree. For the last seven years, I have been a science teacher at Gretna High School. During this time, I have seen the benefits of a strong STEM curriculum including computer science. I have also been highly involved in offering students extracurricular activities in both our rocket and computer clubs. To date, Gretna High School does not offer any focused computer science curriculum. This absence is largely due to a perceived lack of demand and a lack of a clear, rigorous path for certification in computer science for in-service educators. My involvement as both a member and vice president of the local Computer Science Teachers Association (CSTA) has also highlighted a need and desire among many teachers for a program similar to the one proposed.

I have personally researched every single possibility for acquiring a teaching endorsement in the area of computer science in order to broaden my skillset. Many of the programs were either designed for pre-service teachers with more flexible schedules or were light on computer science coursework required. After reviewing UNO's proposed master's degree and certification programs, I can say it is a program that I can both recommend without reservation and would be willing to complete as a means of providing quality computer science education to our students.

Again, I ask that you please consider approving UNO's Master's of Science in Computer Science Education degree to give the educators in our state the opportunity to deliver high-quality computer science education in classrooms statewide.

Sincerely,

Douglas Bertelsen

University of Nebraska Omaha

COLLEGE OF EDUCATION
Office of the Dean

March 19, 2014

Dear Dr. Zhu and Dean Ali:

The College of Education at UNO is pleased to be a strong partner with the College of Information Science and Technology's Department of Computer Science in an Online World Wide proposal to make computer science coursework available to teachers in the Midwest. Computer science coursework offered at the graduate level to support teachers is certainly a dramatic need in Nebraska and across the United States. As stated in your proposal, more than 10,000 AP tests were taken by students in schools across Nebraska last year, only 46 students in the entire state took AP tests in computer science. Your efforts in helping our Nebraska in-service teachers get this important content, and to be able to teach these classes at the high school level, will be of critical help to our local schools.

The ability to offer online coursework in computer science education supports the existing partnership the College has with IS&T and the Computer Science Department to operationalize a supplemental teaching endorsement in computer science, which has already had significant collaboration with the College of Education's Teacher Education Department and Dr. Becky Schnabel, COE student services office. That supplemental endorsement is already under review by the state and this new OWW effort would now take those courses to an online format. We look forward to continued work with you as we package this supplemental endorsement into a degree program option for computer science teachers. Such options are needed to support both AP and dual enrollment coursework in computer science.

Currently the College of Education has a strong group of faculty working on your planning team, including Dr. Neal Grandgenett, Dr. Elliott Ostler, Dr. Vicki Lentfer, and Dr. Neal Topp. We look forward to supporting them as they continue to work closely with you, and we look forward to helping Dr. Grandgenett and Dr. Ostler to eventually offer an online option of their courses.

We wish you the best on your Online World Wide proposal. We are additionally excited to continue working with you in the planning and implementation of this exciting effort. We believe it will provide teachers that are interested in teaching computer science an opportunity to receive the additional graduate level coursework they need to continue providing excellence in the classroom.

Sincerely,

David F. Conway

David F. Conway, Ed.D.
Associate Dean

ldf

6001 Dodge Street / Omaha, NE 68182-0161
402-554-2719 / FAX: 402-554-2879

March 17, 2014

Qiuming Zhu, PhD
Computer Science—281D PKI
University of Nebraska at Omaha
6001 Dodge Street
Omaha, Nebraska 68182

Westside 66
Community Schools

Dear Dr. Zhu

My name is Dawn Nizzi. I am currently a high school science teacher for Westside Community Schools. I teach biology, natural science, ecology, and forensic science at the Westside High School Career Center. I have been involved with the Department of Computer Science at UNO through a variety of opportunities. The opportunities have included the CEENBot/SPIRIT program and the Nebraska Robotics Expo, the RET program, and currently as a founding member of the CSTA-NE Omaha Chapter and teacher sponsor for the Zoo App program.

My involvement in the above programs has opened my eyes to the need in our area for a degree in computer science for teachers already in the classroom. Personally, I would find a Master of Science in Computer Science Education a great fit for where I am in my career. My own research and professional involvement have led me to the conclusion that K-12 students need to be taught computer science as part of their core curriculum. Just as reading and math skills support other content areas, I believe computer science needs to be seen as a support to all other content areas, as well as the career fields students will encounter or create. We have worked hard as educators to make students technology users; we now need to focus on making them technology creators. In order to do so, we need to teach current teachers the skills and knowledge to educate K-12 students in computer science. We cannot wait until the current undergraduates in education fill these positions. Thus, UNO's Master of Science Degree in Computer Science Education can fit that need. Its joint development by faculty in UNO's Department of Computer Science and Department of Teacher Education will include courses from both departments, its predominately online delivery will help it serve the entire state and surrounding areas, and its credit hours will fit the IT Supplemental Endorsement criteria to teach CS Advanced Placement courses.

Thank you to the UNO Department of Computer Science for leading the way to better computer science education for our K-12 students.

Sincerely,
Dawn M. Nizzi
Science Educator Westside High School Career Center
Secretary, CSTA-NE Omaha Chapter

Westside Career Center
3534 South 108th Street
Omaha, NE 68144-4910
phone 402.390.8214

March 19, 2014

Qiuming Zhu, PhD
Computer Science- 281d PKI
University of Nebraska at Omaha
6001 Dodge Street
Omaha, Nebraska 68182

Dear Dr. Zhu,

The Computer Science department in the College of Information Science and Technology has provided me with extensive support over the last three years. My first exposure to computer science at UNO occurred in the form of the Research Experience for Teachers (RET) program which I participated in during its first year and received independent study credits from the college of education for completing. Despite having completed the majority of a master's degree through the College of Education with an emphasis in information technology, I'd had little exposure to programming and programming topics and saw the program as a way to gain valuable experience. The facilitators of the RET program initially taught some basic C programming and Android programming then worked with me to produce a meaningful research project. Since I was teaching English at Millard West at the time, I used graph theory to chart the interactions of characters in seventeen Greek plays and four Shakespearean plays. I learned a great deal during this experience and made valuable connections with UNO faculty and local teachers. I used what I had learned from RET in my English classroom for a year and was very pleased with the increased retention my students had when incorporating computer science into my English curriculum.

One year later my school's computer science teacher unexpectedly resigned two weeks before the school year was set to begin. Despite my emphasis to my administrators that I was far from ready to teach programming, the need for a teacher and my newly added IT endorsement made me the only candidate available to fill the vacancy. The months that followed were riddled with on the job learning of JAVA, JavaScript, PHP, Python, HTML/CSS, and JQuery – all of which I taught as I learned. The more I learned the more I realized I had a great deal more to learn and even though the curriculum has gotten easier for me as time has passed, I still feel this way. UNO has been a source of guidance and opportunities for networking with other educators. Thanks to UNO I became a founding member of the Computer Science Teachers of America Omaha chapter and have gained invaluable resources from teachers from Westside, Bellevue, and Gretna. Additionally, my students participated in UNO's Computer science quiz bowl and programming competition as well as the Nullify Competition, both of which they benefited from. They even came close to placing at every competition (top 75 percent of teams).

The University of Nebraska Omaha's College of Information Sciences and Technology has served Nebraska educators well, but there remains a key need. Advancing technological demands from employers necessitate the provision of programming education by the College of Education so that teachers are prepared to teach students who will work and exist in today's world. Furthermore, the College of Education needs the cooperation of the College of Information Sciences and Technology to create competent future teachers of computer science. This can be accomplished by establishing a Computer Science endorsement through collaborative efforts from the two colleges. Programming at the graduate level has thus far been a course topic reserved for those who already know how to program. Currently there is no undergraduate computer science teaching endorsement option and the graduate IT endorsement does not prepare students to teach secondary computer science courses,

especially Advanced Placement classes. This is a need. In order to have quality educators in this subject area we must have a pathway to master content before being placed in a classroom. The College of Information Science and Technology is the logical hub to find experts and opportunities in this area. A cooperative effort between the College of Education and the College of Information Science and Technology would be mutually beneficial and serve the community. This impact would be visible to the many departments within the University as high school students enter college with backgrounds that can aid them in business, science, technology, and a plethora of other career paths.

In my district I am paired with the business teachers in curriculum planning. Our curriculum focus group recently invited local business leaders to weigh in on the skills they would like to see high school graduates equipped with. They shared that the key focus of our local industry is to see students graduate with more knowledge in the computer sciences, particularly programming. The community needs more post-secondary education to be available in order to make secondary education current and meet the needs of the future of business in Omaha, the state, and the region.

Lastly, in order to give more students valuable exposure to computer science at an early age, in addition to a degree/endorsement path option to certify computer science teachers, the College of Information Science and Technology could further aid the College of Education by offering a single methods course to middle level educators as part of their undergraduate degrees. All middle level teachers could benefit from advanced computer science so that they can prepare their own students for the secondary level.

The University of Nebraska at Omaha has guided me down a new life path. Through the help of the Information Science and Technology department I have survived my first year as a computer science teacher, but the University can be more proactive in preparing teachers. Currently, if teachers are not highly motivated they will not become knowledgeable Computer Science teachers and the students will be the ones who lose. UNO needs to offer an updated Computer Science endorsement in order to grow this key area of STEM education and the College of Information Science and Technology has the industry leaders who can teach future educator.

Thank you for your consideration,

Ramsey D. Young
Computer Science
Millard West High School
5710 S 176th Ave, Omaha, NE 68135
(402) 715-6000

NEBRASKA
DEPARTMENT OF EDUCATION

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301 Centennial Mall South
P.O. Box 94987
Lincoln, NE 68509-4987
TEL 402.471.2295
FAX 402.471.0117

June 27, 2016

Dr. Brian Dorn
PKI 174E
University of Nebraska at Omaha
6001 Dodge Street
Omaha, NE 68182

Dear Dr. Dorn,

Thank you for sharing with the Nebraska Department of Education the outline for the Masters of Science in Computer Science Education program. This program will be a great addition to the courses offered across the state and at the University of Nebraska Omaha to better prepare our teachers to teach courses in Computer Science beyond the "Hour of Code".

At the Nebraska Department of Education, my role is the provide teachers in the area of Communication and Information Systems with resources to help make them successful in the classroom. After speaking with many of the professors at UNO about the possibility of this program, this is a program I would be excited to promote to teachers across the state! With the updating of standards in Communication and Information Systems, Computer Science standards have been integrated into many of the courses within this career field. Business and Industry leaders across the state of Nebraska came together in December 2015 and stressed to us that Computer Science needs to be introduced to students earlier than college. By adding this program to your offerings at UNO, you will be able to provide a program to teachers that will benefit not only their students, but business and industry into the future here in Nebraska.

With the program being overseen by both Computer Science and Teacher Education, this will ensure that teachers not only learn the knowledge and skills needed for Computer Science, but will also learn pedagogy to prepare them for the Computer Science classroom. I have been actively involved with the K-12 Computer Science Framework writing process, and I have heard loud and clear from other states that the biggest hold back from offering more in the K-12 schools around Computer Science is the lack of professional development. I feel that this program would be beneficial for teachers across the state of Nebraska and the United States as Computer Science is being introduced back into the K-12 schools.

Sincerely

Jacqui Garrison

Jacqui Garrison
Career Field Specialist: CIS

TABLE 1: PROJECTED EXPENSES - NEW INSTRUCTIONAL PROGRAM
MS in Computer Science Education at UNO

	(FY 2016-17) Year 1	(FY2017-18) Year 2	(FY 2018-19) Year 3	(FY2019-20) Year 4	(FY 2020-21) Year 5	**Total**
Personnel						
Faculty [1]	$0	$0	$0	$0	$127,000	$127,000
Professional [2]	$0	$0	$0	$0	$0	$0
Graduate assistants	$22,849	$23,534	$24,240	$24,967	$25,716	$121,307
Support staff	$0	$0	$0	$0	$0	$0
Subtotal	$22,849	$23,534	$24,240	$24,967	$152,716	$248,307
Operating						
General Operating [3]	$2,500	$2,500	$2,500	$2,500	$2,500	$12,500
Equipment [4]						$0
New or renovated space [5]						$0
Library/Information Resources [6]						$0
Other						
Subtotal	$2,500	$2,500	$2,500	$2,500	$2,500	$12,500
Total Expenses	25,349	26,034	26,740	27,467	155,216	**260,807**

1 In Year 5, assuming growth and funding from distance education funds, one FTE will be added.

2 The degree program will not require new professional staff and current staff will be used to coordinate the teacher recruitment, admission, advising and certification/credentialing process.

3 The proposed operating budget is in addition to the current budget available for the home unit for the MS in CSE program.

4 None anticipated. Needed equipment for classroom usage and online course development will be obtained from college maintenance funds and other sources.

5 The current classroom space is adequate for the program proposed.

6 The current budget in the college and school are adequate for obtaining library resources.

TABLE 2: REVENUE SOURCES FOR PROJECTED EXPENSES - NEW INSTRUCTIONAL PROGRAM
MS in Computer Science Education at UNO

	(FY 2016-17) Year 1	(FY2017-18) Year 2	(FY 2018-19) Year 3	(FY2019-20) Year 4	(FY 2020-21) Year 5	**Total**
Existing Funds [1]	$25,349	$26,034	$26,740	$154,467	$286,026	$518,617
Required New Public Funds						$0
1. State Funds	$0.00	$0	$0	$0	$0	$0
2. Local Tax Funds (community colleges)	$0	$0	$0	$0	$0	$0
Tuition and Fees [2]	$33,928	$61,156	$62,990	$64,880	$100,240	$323,194
Other Funding						
1						
2						
3						
Total Revenue	$59,277	$87,190	$89,730	$219,347	$386,266	$841,811

1 The college of IS&T will reallocate a GA from the current IS&T GA. In addition, additional funds such as distance education dollars returned to the college will be used to support 1 FTE new faculty in FY 2020-2021 onwards.

2 Calculated as 10 new students taking 12 credit hours in the Spring and Summer of 2017, and 21 credit hours in the years ahead, multiplied by resident tuition and distance education fees ($274.50/credit hour in 2015-16) and increased 3% each year. In FY 2020-21 we expect to increase the the number of students to 15.

University of Nebraska

EXECUTIVE VICE PRESIDENT AND PROVOST

Dec

September 19, 2016

RECEIVED
SEP 20 2016
Coordinating Commission
for Postsecondary Ed.

Dr. Michael Baumgartner
Executive Director
Coordinating Commission for
Postsecondary Education
140 N. 8th Street, Suite 300
Lincoln, NE 68509

Dear Michael:

Enclosed is a copy of the proposal to create a Master of Science in Computer Science Education in the Department of Computer Science in the College of Information Science and Technology at UNO. The proposal was approved by the Board of Regents at the September 16, 2016 meeting. Also enclosed is the Proposal for New Instructional Program Form 92-40.

Please do not hesitate to contact me if you have any questions.

Sincerely,

Susan M. Fritz
Executive Vice President and Provost

Enclosures

c: Chancellor John Christensen
Senior Vice Chancellor B.J. Reed
Dean Hesham Ali, College of Information Science and Technology
Vice Provost David Jackson

Varner Hall / 3835 Holdrege Street / P. O. Box 830743 / Lincoln, NE 68583-0743
(402) 472-5242 / FAX: (402) 472-4240 / www.nebraska.edu

TO: The Board of Regents

Academic Affairs

MEETING DATE: September 16, 2016

SUBJECT: Creation of the Master of Science in Computer Science Education (MS-CSE) in the Department of Computer Science in the College of Information Science and Technology at the University of Nebraska at Omaha (UNO)

RECOMMENDED ACTION: Approval is requested to create the Master of Science in Computer Science Education (MS-CSE) in the Department of Computer Science in the College of Information Science and Technology at the University of Nebraska at Omaha (UNO)

PREVIOUS ACTION: April 10, 2015 – The Board approved the creation of the Executive Master of Science in Information Technology in the College of Information Science and Technology at UNO.

November 9, 1990 – The Board approved the Master of Arts/Master of Science degree program in Computer Science at UNO.

EXPLANATION: The Department of Computer Science and the Department of Teacher Education at UNO propose to collaboratively develop and implement a new Master of Science degree program in Computer Science Education (MS-CSE). The proposed MS-CSE degree program, to be hosted by the College of Information Science and Technology with ongoing collaboration from the College of Education, is designed for students who are interested in teaching computer science at the K-12 level. The primary target students for this MS program are in-service middle- and high-school Science, Technology, Engineering, and Math (STEM) teachers in Nebraska, the eight-state Midwest region surrounding Nebraska, and nationwide – where there is a critical demand for the proposed program.

Graduates of this program will be able to teach secondary-level computing courses including AP Computer Science A, the forthcoming AP CS Principles course that has been in development by National Science Foundation and the College Board, and dual enrollment courses in partnership with University of Nebraska campuses. Second, these teachers will be able to integrate their knowledge of computing with their primary endorsement discipline (which could range from mathematics to science to language or arts); this provides an opportunity for teachers to affect change in their local schools towards universal computational-thinking literacy, even if they are not teaching standalone computer science courses.

This proposal has been approved by the Executive Graduate Council and the Council of Academic Officers. This proposal also has been reviewed and recommended for approval by the Academic Affairs Committee.

PROGRAM COST:	$25,349 Year 1; $260,807 over five years
SOURCE OF FUNDS:	College of Information Science and Technology operating, graduate assistantship pool, and F&A funding
SPONSORS:	B.J. Reed Senior Vice Chancellor for Academic and Student Affairs John Christensen, Chancellor University of Nebraska at Omaha
RECOMMENDED:	Susan M. Fritz Executive Vice President and Provost
DATE:	August 22, 2016